forearm, but the results from suture of the flexor tendons between the distal palmar and the middle finger creases are poor the world over. This can, however, be successful if several details are observed. One is to slit the pulley so the tendon can swell at its juncture without its ischemic necrosis. The sublimis tendon, whenever severed in this area, will adhere to the profundus if it is not removed. Another is to refrain from suturing with silk as it causes adhesions. Instead, stainless steel wire is used as it is the least irritating. It need be placed in only one of the tendon ends as only one is active, the other being passive. Still another precaution against causing adhesions is to place the suture at a distance, namely, in the tendon in the palm, bringing it out the skin at the distal end of the palm to be fastened to a button. In three weeks the wire is withdrawn leaving no suture to irritate. When all these points are observed, there will be the least chance for adhesions and good results will be obtained.

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Infection of the Hand, with Evolution of Chemotherapy*

JOSEPH H. BOYES, M.D., *Los Angeles*

"EVOLUTION" can best be defined as the growth and development in complexity of a subject. As one views the literature on chemotherapy, the word "confusing" should also be added to the definition. In this brief discussion an attempt will be made to present the basic known facts about the two principal chemotherapeutic agents—the sulfonamides and penicillin—and then to discuss "Infections of the Hand" and relate how these chemotherapeutic agents can be used in the treatment of such infections.

The various points on which there is practically general agreement are as follows:

1. The sulfonamides modify the invasive effects of infections due to hemolytic streptococci, pneumococci and meningococci. They increase the "lag" period by inhibiting the growth of organisms. When used locally, it has been shown that they produce more induration in wounds and more hematomata. It has been shown in Meleney's[3] series that they do not lower the incidence of infection in wounds nor do they delay the development of infection. It has also been shown that they do not eliminate the infecting organisms. They are least effective when the local conditions such as traumatized tissue and length of time following injury favor infection. It is now agreed that systemic use of the sulfonamides will do everything that local use of them will do without disadvantages such as increased induration and hematomas in the wound.

2. Penicillin is a chemical produced by a mold which is active against staphylococci and gram-positive organisms in general. It apparently has few toxic effects and is effective if the circulation of the blood can reach the focus of infection. It apparently does not permeate serous or endothelial-lined cavities well and is inactivated by gastric juice. It is less effective in the presence of necrotic tissue and also less effective when the infection is due to mixed organisms.

Briefly then, the sulfonamides are bacteriostatic (prevent the spread of infection but not local infection), are most effective against streptococci. and their use is not indicated locally except to prolong the "lag" period. Penicillin, on the other hand, is not toxic, is effective only if the blood stream can reach the focus, and in any present available form is not effective enough by mouth. Both the sulfonamides and penicillin lose some of their effectiveness in the presence of tissue destruction and under conditions where the local changes in the wound favor infection.

Infections in the hand are predominantly due to staphylococci. Grossmark,[2] in a series of over 100 infections of the hand, found in 36 pulp infections that all were due to staphylococci; of 32 paronychias, 28 were due to staphylococci; in 23 web infections, 14 were due to staphylococci; in nine

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tendon sheath infections, six were due to staphylococci.

Infections of the hand are characterized by the destruction of tissue, partly the effect of the type of organism commonly causing the infection (that is the staphylococcus), but also as a result of another factor; namely, ischemia. The latter results from infection occurring in closed spaces and in tendon sheaths where swelling in channels beneath unyielding ligaments and pulleys produces an ischemia and a consequent death of the tissue from the ischemia. Thus, in infections of the hand we find operating factors which tend to make less effective both the sulfonamides and penicillin.

MOST EFFECTIVE USE

How, then, can we most effectively use the chemotherapeutic agents in infections of the hand?

1. The local use of sulfonamides should be limited to application as a first-aid agent in prolonging the "lag" period; that is, to increase the length of time in which it is safe to do primary repair and closure of the wounds. There is no indication for the use of sulfonamides locally in wounds following debridement and repair.

2. Sulfonamides can be given systemically to prevent the spread of infection, and especially in those cases in which hemolytic streptococci are present. Sulfonamides should be given in adequate doseage, buffered with sodium bicarbonate, making sure that the fluid intake is adequate, and, if prolonged use is necessary, watching carefully for urinary and blood complications.

3. Penicillin can be used locally as an ointment or as an aqueous solution in a compress after the surgical treatment of the infection. It has been shown that, used in this way, penicillin tends to hasten the elimination of organisms from the wound and that it acts as a bactericidal agent.

4. Penicillin systemically can be used in the treatment and the prophylaxis of spreading infection following injury to the hand. Penicillin should be used in adequate doseage (20,000 to 25,000 units every three hours intramuscularly). At the present time, if given by mouth it does not produce adequate concentration unless very large doses are used.

5. It has been shown experimentally that the combination of the sulfonamides and penicillin[1] (especially sulfathiazole and penicillin) produces a bacteriostatic and bactericidal effect which is greater than the sum of the two compounds, so that in severe cases of mixed infections it would be advisable to use both the sulfonamides and penicillin systemically.

SUMMARY

One of the common statements in all of the articles regarding the treatment of surgical infections with penicillin is that chemotherapy is not a substitute for sound surgical principles in the treatment of infection. Early diagnosis, prompt and adequate drainage, rest and elevation are still the primary factors necessary in treating infections of the hand. This is all the more important in those infections of the hand in which swelling is produced in the tissues under the unyielding pulleys in the fingers at the head of the metacarpal bones and the unyielding annular ligament at the wrist resulting in an ischemia and necrosis. Chemotherapeutic agents should be used as an adjunct to the treatment of infections of the hand.

Discussion by STERLING BUNNELL, M.D.

Nowadays seldom do we see the huge infected hands and forearms of yesterday. Due to better understanding of the surgery of infected hands, and now chemotherapy, these have practically disappeared. Cases of tenosynovitis that were treated by penicillin alone very early have been cured, but as soon as the bacteria become entrenched, surgical drainage is necessary. Not all bacteria are susceptible to chemotherapy. Early proper drainage of infected hands is still necessary.

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